GEOGRAPHICAL RECORD

NORTH AMERICA

Physiography and Life Zones of Panama. The reports of the Intercontinental Railway Commission and the studies of the Isthmian Canal Commission have given us at least the outlines of the physiography of Panama. But in an important paper by Edward A. Goldman (Mammals of Panama, *Smithsonian Misc. Colls.*, Vol. 69, No. 5, 1920) we have our knowledge of the physiography applied in the biological field in a manner of special value to geography in that the text is illustrated by a life zones map which is here reproduced. The author conducted a biological survey of Panama, visiting among

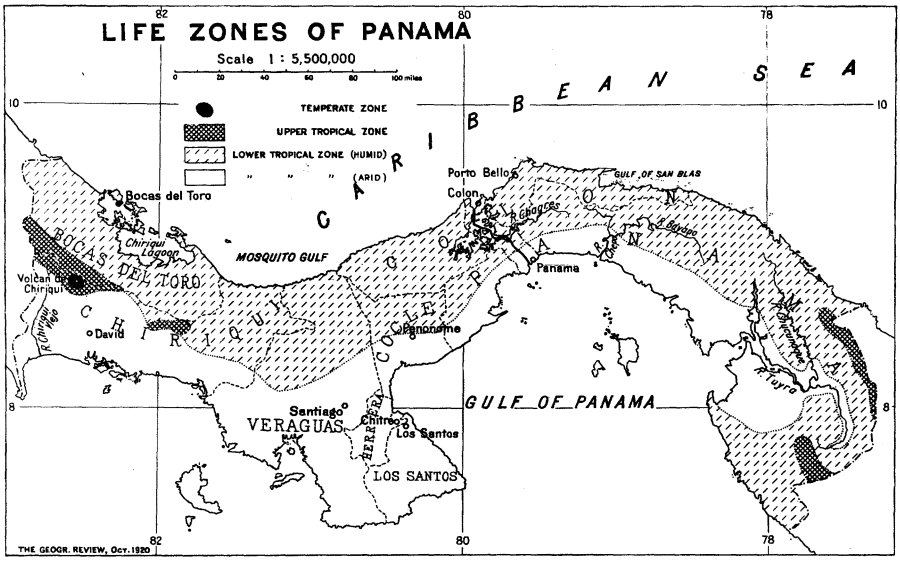

FIG. 1—Map showing the provisional life zones of Panama (after that accompanying the paper cited in the text).

other places the Chagres region, Porto Bello, and eastern Panama. He points out that large areas, including important mountain ranges, remain unexplored. One of the parts least known is the area controlled by the San Blas Indians from which other native tribes and foreigners have been consistently excluded (see S. P. Verner: The San Blas Indians of Panama, in the July number of the *Geographical Review*).

After treating the physiography of the Isthmus of Panama the author passes to the climatic conditions and their faunal relations. So far as the natural life is concerned the study has a peculiar timeliness because the republic of Panama is still sparsely populated, clearings are few, and the natural life as yet relatively undisturbed. The region is especially interesting from the standpoint of biogeography because it is a meeting ground of forms from South America and North America. In Tertiary times oceanic waters probably extended across the isthmus in a number of places—certainly across the Canal Zone, which forms a distinct faunal boundary. For the region as a whole the fauna is so diversified and as yet so little known that any classification into life zones must be regarded as

tentative in character. Three provisional life zones may be recognized. Their characteristics are summarized below:

1. *Lower Tropical Zone.* An area of high temperatures, including by far the greater part of the isthmian land surface. It extends from sea level to 3,000 or 3,500 feet along the higher mountains. Here live most of the animals and plants of the region. The zone is divided into a humid northern and eastern and an arid southern division. The humid division is characterized by a persistent evergreen forest, and the arid division by deciduous foliage and by the interruption of the forest zone by open grassy savanas which become parched in appearance in the dry season.

2. *Upper Tropical or Subtropical Zone.* This zone embraces the crests and slopes of mountains from 3,000 to 8,000 feet in altitude. Almost the entire area is densely forested with palms, and the zone as a whole is humid but with marked differences of precipitation due to varying slope exposure.

3. *Temperate Zone.* This zone extends from 8,000 feet upward, with varying temperatures near the summit. The Volcan de Chiriqui, with summit elevation of 11,500 feet above sea level, is the only place in Panama where the zone is developed. The trees are smaller in size with short trunks and widely spreading branches. The zone seems to have the characteristics of higher zones in the mountains of Costa Rica. It contains representatives of the boreal life zones of North America.

Notes on the Climate of Panama. Were it not for the heavy rainfall of the Canal Zone the great canal locks could not be operated through the four-month dry season. But sometimes there is too much rain water. What would one of our towns look like if in the course of a 7.60-inch rainfall in 24 hours, about 2.50 inches fell in 3 minutes? This seems to have been the experience of Porto Bello, on the Atlantic Coast of Panama, on November 29, 1911. From the automatic record of this cloud-burst it appears that 3.22 inches fell from 12:45 to 1:50 A. M., 0.13 inch from 1:50 to 2:07, 2.47 inches from 2:07 to 2:10, and 0.49 inch from 2:10 to 2:45. Although a rainfall of 2.47 inches in 3 minutes exceeds by 100 per cent the rate of fall during the rain of July 7, 1889, when 8.07 inches fell in 20 minutes at Curtea de Arges, Rumania, heretofore considered the world's record, it seems best to accept this as an actual occurrence (H. G. Cornthwaite: Panama Rainfall, *Monthly Weather Rev.*, May, 1919, pp. 298-302; B. C. Kadel: The Most Intense Rainfall on Record, *ibid.*, May, 1920, pp. 274–276).

The rainfall at Porto Bello in November and December together averages 48 inches, an amount greater than the annual fall over three-quarters of the United States; and, in addition to this, Porto Bello is washed by 10 feet more of rain during the remainder of the year. More than half—most of the Atlantic watershed—of the Canal Zone has an average annual rainfall exceeding 100 inches. Is it any wonder that there are land slides, that a dense tropical jungle flourishes there, that swamps are extensive, and that mosquitoes and the yellow fever and malaria they transmit led to the failure of early canal attempts?

Now that the malignant indirect effects of the excessive rainfall are under control, how can man get along with the tropical heat, the enervating humidity, and the deadening equability? The answer is: daytime cloudiness, a sunlight-absorbing blanket of moist air, and a breeze. The average daytime cloudiness in the dry season, December to March, is about 50 per cent, and in the rainy season, April to November, about 75 per cent. In the dry season the interior and the Pacific side have more cloudiness than the Atlantic side, where the wind comes off the sea clear. In the rainy season the nights are cloudy, while in the dry season the daytime cumulus clouds disappear in the evening. Although Panama is in one of the cloudy belts of the earth, there is, on the average, only one day a month that the sun does not shine; and the longest consecutive period without sunshine of which there is authentic record, was 4 days (H. G. Cornthwaite: Sunshine and Cloudiness in the Canal Zone, *Monthly Weather Rev.* May, 1920, pp. 276–277; Humidity and Hot Weather, *ibid.*, pp. 277–278). Fortunate for man is it, that every day the earth puts up its convectional cloud sunshade.

But this is protection, not relief. A steamy summer's day in the United States shows us occasionally what the weather feels like in Panama during the rainy season. The computed average maximum sensible temperature for July (wet bulb) is 79° F. at Balboa Heights (Pacific side) and 78.5° F. at Cristobal (Atlantic side). The average maximum air temperatures, however, are 87° and 84°, respectively—like St. Louis and Philadelphia in July. A wet-bulb temperature three degrees lower than in the rainy season, and twice as much wind, make the weather of the dry season less oppressive. In spite of the humidity there have been but two deaths from sunstroke and but 21 cases of heat exhaustion in a population of 120,000 in 13 years! The eastern United States has no such record; but perhaps if we worked with no greater intensity than do the people of Panama, our heat-stroke record would be better.

We face a perplexing situation: hot, arid regions with brilliant sunshine—no sunstrokes; a hot, extremely humid region—few sunstrokes; moderately humid, warm regions —occasional sunstrokes; and, finally, we remember that most tropical lowlands with climates apparently like that of Panama are dangerous for the white man who does manual labor or exposes his head to the sun. In Liberia the coastal lowlands have temperature, humidity, cloudiness, and rainfall characteristics much like those of the Atlantic coast of Panama, but a white man can get a "touch of the sun" with only a few minutes exposure, and manual labor, such as is performed constantly by white men in Panama, is here deadly (see Emory Ross: The Climate of Liberia, *Geogr. Rev.*, Vol. 9, 1919, pp. 387–402). Evidently the sunlight is more intense there, and probably also in moderately humid warm regions, than in Panama. Either intense sunlight or high wet-bulb temperatures are livable for the white man, but not the two in combination. From the white man's point of view no description of a tropical climate can be complete without information as to the intensity of sunlight.

CHARLES F. BROOKS

EUROPE

A New Ethnographic Map of Rumania. A first-class contribution to human geography has been made by Professor Emmanuel de Martonne in an article on the ethnography of Rumania (Essai de carte ethnographique des pays roumains, *Annales de Géographie*, March 15, 1920, pp. 81–98). It is the result of extended field work in Rumania, principally in the northern and central Carpathians, and of an examination of all of the available sources of data. His conclusions are particularly important at this time because of their relation to the new boundaries of Rumania as established on the west by the Hungarian treaty and on the south by the Bulgarian treaty. On her eastern frontier Rumania still occupies Bessarabia, but her title to the region has not been confirmed by the Great Powers, who are waiting for the Russian situation to clear up before expressing an opinion as to the merits of Rumania's claims in this direction.

One of the most striking of the author's conclusions is that the boundary on the west is perhaps the most difficult of all because of the intimate mixture of Rumanians and Magyars, as well as other nationalities, precisely in the border zone where a boundary line must be placed. The matter is further complicated by the location of the principal towns, such as Temesvar, Arad, Nagy Varad, and Szatmar-Nemeti, which lie right in the narrow transition zone, and for which there was naturally waged a violent contest, the more so since the towns are connected by a railroad that is the chief line of communication for a large region.

De Martonne finds that the Rumanians are most nearly homogeneous in the regions of former Roman colonization, that is, in western Wallachia, the eastern Banat, and western Transylvania. They are most mixed in those portions of the country long included in neighboring states of different nationality, either during many centuries as in Transylvania or during the course of the last century only as in Bukovina and Bessarabia. The purest Rumanian populations are found in the Carpathian valleys.

Rumanians appear for a long time to have preferred the forested regions of considerable relief, rich in water and pasturage. Movement to the plains and the absorption of foreign

elements that existed there were later developments. In pushing outward the population has not stopped at natural boundaries, and this invites comment by the author to the effect that a map constructed on a geographical principle would show relations between the history and the physical geography that are hidden in maps constructed on a purely statistical principle.

The special value of de Martonne's map lies not alone in the care exercised in its construction but also in his choice of three shades of density which permit one to see at a glance not only the nationality involved at a given point but its relative density, which means, in general, its relative importance. The larger cities are represented by divided circles that show the nationality percentages.

AFRICA

The Development of the Coastal Belt of South Africa. On the eastern and southern coasts of South Africa there is a belt averaging 100 miles wide, varying in elevation from sea level to 6,000 feet, with a great variety of climate and of vegetable products. Fruits of almost every sort grow prolifically. Stock raising is carried on, farm products of wide variety can be produced. In any study of the possibilities of future white settlement in South Africa this coastal belt has unusual importance, since it is capable of much greater agricultural development in contrast to the high but relatively temporary development about Kimberley (diamonds) and Johannesburg (gold). There has now been published a paper of considerable interest to geographers in that the economic geography of the region is set forth systematically (T. Caink: The Possibilities and Development of the Coastal Belt of South Africa, *South African Journ. of Sci.*, Vol. 16, 1919, pp. 211–225).

The author has made a detailed study of the rainfall distributions and the run-off; and he finds that an important part of the coastal belt enjoys a rainfall above 40 inches, and some of it as high as 70 inches. Detailed tables are given. The belt of more intense rainfall is from 10 to 30 or 40 miles wide and roughly 1,000 miles in length. To be conservative the author takes an average width of 15 miles, giving a total catchment area for the belt of 15,000 square miles. From a study of the general resources of the region he would propose, not white settlement in the region of heavier rainfall, but the absence of settlement and the development of a forest cover. He would then introduce the principles of irrigation, storing the water for the dry season and encouraging particularly the practice of building small irrigation works for tributary supplies. To carry out the plan he advocates the purchase of the rain belt by the government, the development of a forest cover, the equalization of run-off, the building of railways, and the development of water power. With an abundance of cheap labor and a favorable combination of sunshine and water supply, he would turn the region into one of intensive agriculture and industrial development. The oil, nuts, rubber, cocoa, and cotton that now go by steamer to Europe he would bring from tropical Africa to South African ports to be manufactured, in the coastal belt, for export. He arrives at the conclusion that the whole coastal belt of 85,000 square miles could eventually become a great industrial center like England with a population of 50,000,000, or 600 to the square mile.

AUSTRALASIA AND OCEANIA

The Tapestry Forests of Hawaii. Associated with the more humid aspects of the highly dissected Hawaiian topography is a peculiar form of the rain forest to which Vaughan MacCaughey gives the name "tapestry forest" (Hawaii's Tapestry Forests, *Botanical Gazette*, August, 1920, pp. 137–147).

The tapestry forest is developed on the precipitous slopes that to the eye appear almost vertical. Actually the range of these slopes is between 40° and 80°, averaging 50° – 60°. In altitude this forest ranges between 800 and 4,500 feet. It presents a primitive appearance, steepness, wetness, and general inaccessibility having prevented the devasta-

tions wrought by man and animals on the lower slopes. The struggle against wind and gravity leaves a marked impress on the trees. They are dwarfed and gnarled and distinguished by a remarkable system of anchoring and bracing roots. Where erosion has removed the scant soil cover the roots are exposed as a sort of natural ladder utilized by natives and woodsmen in climbing slopes that otherwise would not infrequently prove impossibly steep. There is an abundant shrubby undergrowth. At the lower elevations lianas form almost impenetrable jungles. Above 2,000 feet, where fog and mist prevail throughout the greater part of the year, lianas give place to damp soggy moss formations. The foliage in general tends to small, glossy leaves which with the general similarity in the shape of the tree crown contributes towards uniformity in appearance. Individual trees are distinguished by differences in the green tints. Looked at from below this heightens the effect of drapery expressed in the appropriate term tapestry forest.

WORLD AND LARGER PARTS

Who Owns the Earth? Under this title J. E. Spurr analyzes the mineral wealth of the world and the relative positions of the United States, England, and Japan (*Engineering and Mining Journ.*, Vol. 109, 1920, pp. 388–391). The chief value of the paper lies not in its political discussions but in its two accompanying diagrams showing, the one, the comparative commercial (financial) control and the other, the territorial (political) control of eighteen minerals by principal producing countries. Some of the most important conclusions are as follows. The United States produced, in 1917, 71 per cent of the world's petroleum. It leads in the production of iron and steel, copper and lead, sulphur, phosphate rock, vanadium, aluminum, and several other mineral products. The British Empire leads in tin—a key industry—and in nickel, gold, graphite, and tungsten; it is fast gaining on the United States in petroleum production and is second to us in coal. Russia formerly (1913) led in manganese production, but the effect of present conditions is to give Britain the lead. Territorially Spain is foremost as a producer of mercury but financially the industry is dominated by Britain. Of the few minerals remaining outside the control of the United States and the British Empire, the chief are the nitrates of Chile and the potash reserves now divided almost equally between France and Germany. The paper contains opinions by the author as to the effect of these distributions upon the political policies of the leading industrial nations.